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PATENT

METHOD OF ATTACHING AN ELECTRIC CONDUCTOR TO AN ELECTRICALLY CONDUCTIVE TERMINAL VIA A TELESCOPING SLEEVE

Continuing Data

This application is a divisional of U.S. application Serial No. 09/754,651 filed January 4, 2001.

Background of the Invention

This invention relates to electrical connections and methods of attaching an electric conductor to an electrically conductive terminal.

Electric motors and other electro-magnetic devices typically have direct connect terminals in which the terminal is secured to an electric conductor for a magnet. To attach the conductor to the terminal, some of the conductor's cladding must first be trimmed to expose an end portion of the conductor's

wire. The exposed end of the wire is then inserted into the terminal. The terminal is then crimped in two locations. One of the crimps secures the exposed end of the wire to the terminal so that the wire is electrically coupled to the terminal. The other crimp secures the conductor's cladding to the terminal.

The conductor is generally required to be a precise length. Often, too much of the cladding is trimmed during the attaching process. If too much cladding is trimmed, then the cladding is not sufficiently long to reach the terminal. In some cases the cladding can be pulled out a sufficient length from the stator slot to enable the cladding to reach the terminal. In other cases, adjustment of the cladding cannot be accomplished at all.

Because of the difficulties caused by too much of the cladding being trimmed, the prior art has focused on prevention. Presently, the trimming operation is performed via a hand-held device which singes or melts the cladding a fixed distance from the end of the wire. Removing a fixed length of the cladding prevents a situation in which too much of the cladding is trimmed. However, hand-held devices having two-edge singe blades are generally awkward to use and must be rotated 360 degrees around the conductor to produce complete separation. Melting of the cladding sometimes produces an uneven cut, making it difficult to locate and to securely crimp the cladding into the insulation crimp of the terminal. The melting process also produces noxious gasses that require ventilation.

Summary of the Invention

Among the several advantages of the present invention is the provision of an improved method of attaching an electric conductor to an electrically conductive terminal; the provision of such a method in which the electric conductor's cladding need not be trimmed to a particular length; the provision of such a method in which the cladding need not be trimmed in a particular manner and in which the end of the cladding need not be evenly cut; and the provision of an electrical connection which overcomes the disadvantages of prior art connections.

In general, a method of the present invention is for attaching an electric conductor to an electrically conductive terminal. The electric conductor comprises a wire and a cladding surrounding the wire. The cladding is of an electrically insulative material. The wire has an exposed end portion extending from an end of the cladding. The method comprises placing a sleeve over the electric conductor. The sleeve is of an electrically insulative material. The method further includes positioning the exposed end portion of the wire adjacent the terminal, securing the exposed end portion of the wire to a first portion of the terminal in a manner so that the exposed end portion of the wire is mechanically secured to and electrically coupled to the terminal, moving the sleeve along the electric conductor to a position in which a portion of the sleeve is adjacent the terminal, and securing the sleeve to a second portion of the terminal in a manner so that the sleeve is mechanically secured to the terminal.

Another aspect of the present invention is an electrical connection comprising an electric conductor, an electrically conductive terminal and a sleeve. The electric conductor has a wire and a cladding surrounding the wire, the cladding is of an electrically insulative material. The wire has an exposed end portion extending from an end of the cladding. The terminal has a first portion and a second portion. The sleeve surrounds the electric conductor and is of an electrically insulative material. The exposed end portion of the wire is secured to the first portion of the terminal in a manner so that the exposed end portion of the wire is mechanically secured to and electrically coupled to the terminal and so that the second portion of the terminal is generally between the end of the cladding and the first portion of the terminal. The sleeve is secured to the second portion of the terminal in a manner so that the sleeve is mechanically secured to the terminal. The sleeve covers the end of the cladding and a protected portion of the wire. The protected portion of the wire extends from the first portion of the terminal to the end of the cladding.

Other objects and features will be in part apparent and in part pointed out hereinafter.

Brief Description Of The Drawings

Fig. 1 is a perspective view of an electrical connection of the present invention, the connection having an electric conductor, electrically conductive terminal, and sleeve, the electric conductor having a wire and cladding

surrounding the wire with an exposed end portion of the wire extending from an end of the cladding, the conductor and sleeve being spaced from the terminal;

Fig. 2 is a perspective view similar to Fig. 1 but with the wire of the conductor positioned adjacent the terminal and with wire holding tabs of the terminal bent to hold the wire;

Fig. 3 is a perspective view similar to Fig. 2 but with the sleeve slid into contact with the terminal; and

Fig. 4 is a perspective view similar to Fig. 3 but with insulation holding tabs of the terminal bent to hold the sleeve.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Description Of The Preferred Embodiment

Referring now to the drawings, an electrical connection of the present invention is indicated in its entirety by the reference numeral 20. The electrical connection 20 comprises a electric conductor, generally indicated at 22, an electrically conductive terminal, generally indicated at 24, and a sleeve, generally indicated at 26. Preferably, the electric conductor 22 is a conductor of an electro-motive device, and more preferably is a conductor of an electric motor, generally indicated at 28 (Fig. 4). The electric conductor 22 includes a wire 30 and cladding 32 surrounding the wire. The wire 30 is of an electrically conductive material, such as copper, and has an exposed end portion 30a

extending from an end 32a of the cladding. The cladding 32 is of an electrically insulative material, such as Mylar® or any other suitable material.

The terminal 24 includes a conductor-receiving region, generally indicated at 36, for receiving the conductor 22, and a terminal-receiving region, generally indicated at 38, adapted for connection to a terminal of a device (not shown), such as a house-hold appliance. Preferably, the wire-receiving region 36 comprises an elongate channel sized for receiving a portion of the conductor 22 and a portion of the sleeve 26. The conductor-receiving region 36 comprises a pair of wire-engageable tabs 40a, 40b, and a pair of insulation-engageable tabs 42a, 42b. As discussed in greater detail below, the tabs 40a, 40b, 42a, 42b are adapted to be crimped in a manner to hold the wire 30 and sleeve 26. As shown in Figs. 1 and 2, the wire-engageable tabs 40a, 40b are spaced from one another before being crimped, and the insulation-engageable tabs 42a, 42b are spaced from one another before being crimped.

The sleeve 26 is of an electrically insulative material surrounding the conductor 22, and is preferably of the same material as the cladding 32. Preferably, the sleeve 26 is sized for sliding along the exterior of the cladding 32. In particular, the inside diameter of the sleeve 26 is preferably slightly larger than the outside diameter of the cladding 32. Also preferably, the sleeve 26 is of a flexible, one-piece construction and completely circumscribes the conductor 22.

To attach the electric conductor 22 to the terminal 24, the sleeve 26 is placed over the conductor so that the sleeve surrounds an intermediate portion of the conductor and is spaced from the exposed end portion 30a of the wire 30 and the end 32a of the cladding 32. The exposed end portion 30a of the wire 30 is placed in the conductor-receiving region 36 of the terminal 24 adjacent the wire-engageable tabs 40a, 40b. The wire-engageable tabs 40a, 40b are then crimped or otherwise bent (see Fig. 2) to secure the exposed end portion 30a of the wire 30 to the terminal 24. The tabs 40a, 40b mechanically secure and electrically couple the exposed end portion 30a to the terminal 24. As shown in Fig. 2, the cladding end 32a is slightly spaced from the insulation-engageable tabs 42a, 42b. Thus, crimping of the insulation-engageable tabs 42a, 42b would not engage the cladding 32. As shown in Fig. 3, the sleeve 26 is slid longitudinally along the conductor 22 to a position in which a portion of the sleeve is adjacent the insulation-engageable tabs 42a, 42b. The insulation-engageable tabs 42a, 42b are then crimped or otherwise bent (see Fig. 4) to engage the sleeve 26 in a manner to mechanically secure the sleeve to the terminal 24. The sleeve 26 is sufficiently long so that the sleeve covers the cladding end 32a when the sleeve is secured by the insulation-engageable tabs 42a, 42b. The sleeve 26 also covers a protected portion of the wire 30, i.e., the region of the wire's exposed portion 30a which is covered by the sleeve. In this embodiment, the protected portion of the wire 30 is the region of the wire which extends from

the insulation-engageable tabs 42a, 42b to the cladding end 32a (not shown in Fig. 4).

Although the steps involved in attaching the conductor 22 and sleeve 26 to the terminal 24 have been described as occurring in a particular order, it is to be understood that the order of the steps is not critical. For example, although the step of crimping the wire-engageable tabs 40a, 40b preferably occurs before the step of crimping the insulation-engageable tabs 42a, 42b, it is to be understood that the insulation-engageable tabs could be crimped first without departing from the scope of this invention.

Because of the use of the sleeve 26, the conductor's cladding 32 does not need to be trimmed to a particular length. In other words, the exposed end portion 30a of the wire does not need to be a particular length. If the exposed end portion 30a is relatively short, then both the sleeve 26 and the cladding end 32a will be crimped by the insulation-engageable tabs 42a, 42b. If the exposed end portion 30a is relatively long such that the cladding end 32a is spaced from the terminal, then sleeve 26 serves to cover the portion of the wire extending from the tabs 42a, 42b to the cladding end. Also, because the sleeve 26 preferably has even ends, it does not matter whether the cladding end 32a is smooth or uneven.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above methods without departing from the scope of the invention, it is intended that all matter

contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.